

AMENDMENTS TO THE CLAIMS

Listing Of Claims

1. (currently amended) A semiconductor package comprising:

a substrate comprising a first side, an opposing second side, a plurality of die contacts on the first side, and a plurality of bonding sites on the second side in electrical communication with the die contacts, each bonding site comprising an electrically conductive, bondable metal;

a semiconductor die on the first side comprising a plurality of bond pads bonded to the die contacts; and

a plurality of external contacts on the second side, each external contact comprising a multi layered metal bump including a first metal layer on a bonding site, a second metal layer on the first metal layer, and a non-oxidizing outer layer on the second metal layer;

each external contact having a height H on the substrate equal to a combined thickness of the bonding site, the first metal layer, the second metal layer and the outer layer;

the height H selected to reduce an overall thickness T1 of the package to between about 0.1 mm to 1.4 mm.

2. (currently amended) The semiconductor package of claim 1 wherein the external contacts are generally pyramidal in shape with planar tip portions.

~~die contacts comprise multi layer metal bumps.~~

3. (withdrawn) The semiconductor package of claim 1 wherein the die is back bonded to the first side and wire bonded to the die contacts.

4. (previously presented) The semiconductor package of claim 1 wherein the electrically conductive, bondable metal comprises copper, the first metal layer comprises copper, the second metal layer comprises nickel, and the non-oxidizing outer layer comprises gold.

5. (previously presented) The semiconductor package of claim 1 wherein the substrate comprises a material selected from the group consisting of organic polymer materials, epoxy resins, and polyimide resins.

6. (withdrawn) The semiconductor package of claim 1 wherein the die is wire bonded to the die contacts in a chip-on-board configuration.

7. (withdrawn) The semiconductor package of claim 1 wherein the die is wire bonded to the die contacts in a board-on-chip configuration.

8. (withdrawn) The semiconductor package of claim 1 wherein the substrate includes a recess and the die is contained in the recess in contact with a metal heat spreader.

9. (currently amended) A semiconductor package comprising:

a substrate having a first side and an opposing second side;

a plurality of die contacts on the first side in a pattern, and a plurality of external contacts on the second side in an array in electrical communication with the die contacts, each die contact and each external contact comprising a generally pyramidal shaped multi layered metal bump having a planar tip portion configured to facilitate bonding to the substrate,

each die contact and each external contact including a base metal layer on a bonding site, a bump metal layer on the base metal layer and a non-oxidizing outer metal layer on the bump metal layer; and

a semiconductor die flip chip mounted to the first side, the die comprising a plurality of bond pads in the pattern bonded to the die contacts.

10. (previously presented) The semiconductor package of claim 9 further comprising an encapsulant on the substrate encapsulating the die and the first side.

11. (previously presented) The semiconductor package of claim 9 wherein the base metal layer comprises copper, the bump metal layer comprises nickel, and the non-oxidizing outer metal layer comprises gold.

12. (currently amended) The semiconductor package of claim 9 wherein a height H of each die contact and each external contact is about 5 μ m.

~~each die contact and each external contact is generally pyramidal in shape with a planar tip portion.~~

13. (previously presented) The semiconductor package of claim 9 further comprising a solder mask on the second side configured to electrically insulate the external contacts.

14. (currently amended) A semiconductor package comprising:

a substrate having a first side, and an opposing second side;

a plurality of die contacts on the first side comprising first multi layered metal bumps in a pattern having generally planar first tip portions;

a plurality of bonding sites on the second side in an array in electrical communication with the die contacts, each bonding site comprising an electrically conductive, bondable metal;

a plurality of external contacts on the bonding sites in electrical communication with the die contacts comprising second multi layered metal bumps having generally planar second tip portions configured to facilitate bonding of the package to a supporting substrate, the external contacts having a height H on the substrate selected to reduce an overall thickness T1 of the package to between about 0.1 mm to 1.4 mm; and

a semiconductor die flip chip mounted to the substrate, the die comprising a plurality of bond pads in the pattern bonded to the die contacts.

15. (previously presented) The semiconductor package of claim 14 wherein each first multi layered metal bump and each second multi layered metal bump comprises a copper layer, a nickel layer and a gold layer.

16. (previously presented) The semiconductor package of claim 14 further comprising an encapsulant on the substrate encapsulating the die.

17. (previously presented) The semiconductor package of claim 14 wherein the bonding sites and the external contacts are in a grid array.

Claims 18-57 (canceled).

58. (currently amended) An electronic assembly comprising:

a supporting substrate comprising a plurality of electrodes;

at least one semiconductor package on the supporting substrate comprising:

a substrate comprising a plurality of bonding sites, each bonding site comprising an electrically conductive, bondable metal;

a semiconductor die on the substrate comprising a plurality of bond pads in electrical communication with the bonding sites; and

a plurality of external contacts on the bonding sites bonded to the electrodes on the substrate, each external contact comprising a generally pyramidal shaped multi layered metal bump having a planar tip portion configured to facilitate bonding to an electrode on the supporting substrate, each external contact including a first metal layer on a bonding site, a second metal layer on the first metal layer, and a non-oxidizing outer layer on the second metal layer.

59. (previously presented) The assembly of claim 58 wherein the substrate and the package are configured as a multi chip module.

60. (previously presented) The assembly of claim 58 wherein the first metal layer comprises copper, the second metal layer comprises nickel, and the non-oxidizing outer layer comprises gold.

61. (previously presented) The assembly of claim 58 wherein the package further comprises a plurality of die contacts on the substrate in electrical communication with the external contacts, the die contacts comprising multi layer metal bumps bonded to the bond pads on the die.

62. (currently amended) An electronic assembly comprising:

a supporting substrate comprising a plurality of electrodes; and

a semiconductor package comprising a substrate having a first side and an opposing second side, a plurality of die contacts on the first side comprising first multi layered metal bumps having generally planar first tip portions, a plurality of bonding sites on the second side in electrical communication with the die contacts comprising an electrically conductive bondable metal, a semiconductor die bonded to the die contacts in a flip chip configuration, and a plurality of external contacts on the bonding sites—comprising second multi layer metal bumps having generally planar second tip portions bonded to the electrodes,

each external contact having a height H on the substrate equal to a combined thickness of a bonding site and a multi layer metal bump, the height H selected to reduce an overall thickness T1 of the package to between about 0.1 mm to 1.4 mm.

63. (previously presented) The assembly of claim 62 wherein each die contact comprise a copper layer, a nickel layer and a gold layer.

64. (previously presented) The assembly of claim 62 wherein each external contact comprise a copper layer, a nickel layer and a gold layer.